

## SENSOR FUZED WEAPON (SFW)



### Air Force ACAT IC Program

Total Number of Systems:	5,000
Total Program Cost (TY\$):	\$2060.2M
Average Unit Cost (TY\$):	\$0.334M
Full-rate production:	3QFY96
SFW P3I:	4QFY01/02

### Prime Contractor

SFW: Textron Systems Corporation
WCMD: Lockheed Martin

### SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2020

The CBU-97/B Sensor Fuzed Weapon (SFW) is a 1000 pound class, unpowered, air-delivered, wide area cluster munition designed to provide multiple kills per pass against armored and support vehicles. The system has been certified on the A-10, B-1, B-2, B-52, F15, F-16 and is designed to be compatible with various USN/USMC, and NATO aircraft. The weapon has the capability of being delivered in adverse weather conditions, day or night, at various altitudes and airspeeds. SFW consists of a SUU-66/B Tactical Munitions Dispenser (TMD), which houses ten BLU-108/B submunitions. Each submunition contains four projectiles, an orientation and stabilization system, a radar altimeter, and a rocket motor. After spin-up and release from the submunitions, the projectiles scan the area under their flight path with a two-color passive infrared sensor, while signal processing logic classifies and filters out false targets. Upon detecting a valid target, an electronic pulse detonates an explosive charge, driving an

explosively-formed penetrator (EFP), an aero-dynamically stable slug, into the target. The SFW will be stored and transported as an all-up-round in the CNU-411A/E container. For typical tactical sorties, a combat load consists of four to six CBU-97/Bs. The SFW can be delivered at low or high altitudes (200 feet AGL to 40,000 feet MSL (w/ Wind Corrected Munitions Dispenser (WCMD) tail kit)) and at low through supersonic speeds (250-650 knots). The SFW program is closely related to the WCMD and Joint Standoff Weapon (JSOW) Programs. SFW will begin to be retrofitted with WCMD tail kits in April of 2001. All SFWs will be retrofitted with the WCMD tail kit and will become CBU-105s. The SFW BLU-108 submunition will be a payload in the JSOW AGM-154B. SFW supports the *precision engagement* component of *Joint Vision 2020*.

## **BACKGROUND INFORMATION**

The SFW program entered full-scale development in 1985. After a DAB program review, USD(A&T) authorized LRIP in March 1992. In November 1994, USD(A&T) delegated the full-rate production decision to the Assistant Secretary of the Air Force for Acquisition. The Air Force Milestone III Acquisition Decision Memorandum was signed in June 1996.

Due to range safety restrictions, CBU-97/B IOT&E testing was restricted to deliveries below 3,000 ft AGL. Therefore, system effectiveness from high altitude releases (above 3,000 ft AGL) was not validated. The effects of launch transients, ballistic errors, and unknown winds on TMD performance from medium to high altitudes, could not be validated. The BLRIP report submitted in May 1996 determined that SFW has only been proven operationally effective when employed at low altitudes using level or shallow angle dive deliveries.

The Wind Corrected Munitions Dispenser program was implemented to expand SFW employment options based upon a change to the Air Force's air doctrine. SFW was designed for low altitude, direct attack delivery profiles consistent with cold war, European scenario tactics. DESERT STORM experience resulted in air doctrine favoring high altitude deliveries, well outside the SFW's original concept of operation delivery mode. The WCMD program optimized SFW targeting to reflect the change in air doctrine favoring high altitude releases.

The Wind Corrected Munitions Dispenser is an inertial guidance tail kit that replaces the existing tail section of current inventory area attack weapons, including the Sensor Fuzed Weapon, to improve delivery accuracy when released from medium to high altitude. The Sensor Fuzed Weapon with the Wind Corrected Munitions Dispenser is designated as a CBU-105.

In 1996, the Air Force instituted a Preplanned Product Improvement (P3I) program as a low-cost force multiplier performance upgrade to the CBU-97A/B. The P3I program involves three major improvements: (1) improving performance against countermeasures; (2) altering the warhead design to improve performance against softer targets without degrading the current target-set performance; and (3) raising the radar altimeter height of function to increase area coverage. The current sensor will be upgraded from passive-only to a dual-mode active passive type. This upgrade will enhance the sensor's performance against cooler targets and improve weapon aimpoint. The Sensor Fuzed Weapon P3I submunition is designated a BLU-108B/B and the "all-up-round" is designated the CBU-97B/B.

Two Producibility Enhancement Program (PEP) hardware upgrades were initiated for SFW to reduce costs and improve producibility through design improvement. The first, PEP-1, involves

electronic and mechanical changes to the projectile. The second, PEP-2, involves redesign of the sequencer and altimeter into one integrated submunition electronics unit.

The Sensor Fuzed Weapon TEMP was updated and approved in July 2000 to reflect changes in the test program. FOT&E 1 was completed in 1998. All objectives were met and testing results indicated that PEP-1 changes have not degraded the performance of the Sensor Fuzed Weapon. However, the PEP-2 program, and subsequently FOT&E 2, were cancelled due to technical problems. Critical technology elements from the PEP-2 program are being integrated into the P3I program.

Program delays for Sensor Fuzed Weapon P3I led to the development of an interim configuration (BLU-108C/B) for the JSOW AGM-154/B, incorporating only an insensitive munitions fill—PBXW-11. This submunition is planned for incorporation in the initial production configuration of the Joint Standoff Weapon (JSOW) AGM-154B.

The CBU's experienced premature high altitude dispenses in Sensor Fuzed Weapon lot acceptance testing and Wind Corrected Munitions Dispenser Developmental Testing. An Air Force Red Team determined the most probable cause of failure to be the proximity fuze. Analysis showed that occurrence of early opening events fell within stated reliability of the FZU-39 fuze. The Sensor Fuzed Weapon will be retrofitted with a cable similar to the CBU-87. The cable, running from the nose to the tail, will allow the WCMD tail kit to inhibit early dispense.

The DOT&E-approved LFT&E strategy for SFW P3I will be completed in two phases. Phase I will include: (1) collection of sensor data against a representative target set to determine impact points; (2) warhead performance data against armor plate targets; and (3) three test shots that repeat shotlines from the original SFW testing in 1990. An optional Phase II test will consist of a maximum of seven additional tower shots determined after the results of Phase I have been reviewed.

## **TEST & EVALUATION ACTIVITY**

The Sensor Fuzed Weapon P3I underwent developmental testing during FY00. During initial warhead characterization testing in Apr 00, a warhead discrepancy was discovered. Warhead examination revealed a loose liner and loose explosive billet. This condition was evident in 26 of 28 warheads examined. Characterization testing was halted, fixes were incorporated into the design and characterization testing resumed on 25 September. The fixes included crimping, sealer, adhesive, and environmental conditioning. LFT&E Phase I events were completed in Dec 00, delayed due to a second warhead investigation. Results are being analyzed. The second corrective action taken was the elimination of the powder overfill initially included after the first warhead discrepancy. Current warhead corrective actions now include a new liner crimp and fill-lower housing adhesive.

In early CY 00, the SFW contractor, conducted live development flight tests of the P3I SFW. Results from these tests provided enough confidence to proceed into qualification testing. The Government began Sensor Fuzed Weapon P3I DT/OT flight test in Sep 00 and is scheduled to complete in Feb 01 using operationally representative delivery profiles, including WCMD.

Wind Corrected Munitions Dispenser IOT&E flight test completed Jun 00.

The SFW Program Office conducted two qualification flight tests from high altitude to verify FZU-39 assembly line quality improvements. Further testing of the early dispense inhibit will be

conducted during the WCMD LRIP III test program. Four to five high altitude SFW drops are planned with the new cable and WCMD tail kit.

FOT&E III for end-to-end testing of the P3I configuration is currently planned to begin FY02 using the first production weapons.

## **TEST & EVALUATION ASSESSMENT**

Operational testing of the Wind Corrected Munitions Dispenser demonstrated additional Sensor Fuzed Weapon employment capability from medium and high altitude. However, the Sensor Fuzed Weapon program encountered schedule delays due to development problems with the planned P3I.

Wind Corrected Munitions Dispenser test results resolved the outstanding issues from the Operational Test and Evaluation Report on the Sensor Fuzed Weapon (CBU-97/B) on medium and high altitude performance. AFOTEC rated the overall Wind Corrected Munitions Dispenser, including the Sensor Fuzed Weapon, CBU-105, as operationally effective and suitable when employed against the design target set. Weapon accuracy exceeded requirements. Weapon reliability met requirements for operational life for both threshold platforms, number of power-on cycles to failure and weapon power-on cycle time. WCMD did not meet the requirements for storage reliability, service life and mission reliability. Additionally, while no significant problems were encountered with the F-16, WCMD did not prove to be interoperable with the B-52H due to a number of weapon built-in-test failures and a lack of display of weapon status. All deficiencies identified above have been corrected and confirmed through regression testing during the IOT&E timeframe. AFOTEC recommended end-to-end test including weapon releases with corrections before release to operational B-52 units.

Premature high altitude dispenses in Sensor Fuzed Weapon lot acceptance testing and Wind Corrected Munitions Dispenser Developmental Testing experienced by CBUs and attributed to the proximity fuze did not occur during operational testing. FZU-39 assembly line quality improvement qualification flight test results met specification requirements.

Delays in the P3I submunition development affected the planned cut-in date for P3I into both Sensor Fuzed Weapon and Joint Standoff Weapon and will result in the procurement of fewer P3I versions of these weapons. The combined DT/OT will provide results for P3I cut-in decision. However, the delays led the Joint Standoff Weapon AGM-154B program to plan initial production with the BLU-108C/B submunition, which lacks P3I improvements.

## **CONCLUSIONS, RECOMMENDATIONS AND LESSONS LEARNED**

The incorporation of the PBXW-11 IM fill has proven to be more difficult than anticipated. With “drop-in” explosive fill substitutions for IM and cost reasons proposed, the technical challenges should not be underestimated.

Emerging results of DT/OT TMD drops with BLU-108B/B submunitions and contractor test results suggest that LFT&E optional Phase II Tower Test shots are necessary to examine the lethality of the MEFPs against light armor and truck targets.